PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 16 June 2000 (16.06.00)	
International application No. PCT/DK99/00579	**Applicant's or agent's file reference** 16.669
International filing date (day/month/year) 22 October 1999 (22.10.99)	**Priority date** (day/month/year) 23 October 1998 (23.10.98)
Applicant JENSEN, Erik, Albert	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

17 May 2000 (17.05.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Manu Berrod
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

15

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
16.669		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/DK99/00579	22/10/1999	23/10/1998
International Patent Classification (IPC) or national classification and IPC H03F3/30		
Applicant BANG & OLUFSEN A/S et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 11 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
17/05/2000	06.02.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Kurzbauer, W Telephone No. +49 89 2399 7479

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/DK99/00579

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:
Description, pages:

1,3-9	with telefax of	13/10/2000
2	with telefax of	26/01/2001

Claims, No.:

1-5	with telefax of	13/10/2000

Drawings, sheets:

1/5-5/5	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

☐ the description, pages:

☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-5
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-5
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-5
	No:	Claims	

2. Citations and explanations
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1: 'Schaltungen zur Ansteuerung der Farbbildröhre' FUNKSCHAU, PART I, no. 21, 1987, page 60 XP002900931
D2: 'Schaltungen zur Ansteuerung der Farbbildröhre' FUNKSCHAU, PART II, no. 22, 1987, pages 83-86, XP002900932
D3: 'Schaltungen zur Ansteuerung der Farbbildröhre' FUNKSCHAU, PART III, no. 23, 1987, pages 53-56, XP002900933
D4: US-A-4 293 875 (KATZ BERNARD R) 6 October 1981 (1981-10-06)
D5: US-A-4 114 109 (CAMPIONI ARMANDO) 12 September 1978 (1978-09-12)
D6: US-A-4 097 815 (CAMPIONI ARMANDO) 27 June 1978 (1978-06-27)
D7: US-A-5 546 048 (SANO YUJI ET AL) 13 August 1996 (1996-08-13)
D8: US-A-5 661 436 (KRESOCK JOHN MICHAEL) 26 August 1997 (1997-08-26)

In the video amplifiers disclosed in documents D1-D3 the elevating of the static component is not performed by a separate transistor but they employ a clamp circuit in order to perform a level shift of the static component.

In document D4 no linear amplifier is disclosed and no feedback is performed in the amplifying circuit. Despite it is true that the principle of level shifting is in fact the same as the one claimed in claim 1, it is also true that there is no indication for a person skilled in the art to linearize the circuit and in consequence to apply feedback.

In the circuit disclosed in documents D5 and D6 no transistor performs level shifting of the static component and the base of the upper driving transistor is not driven by the static component.

In the video output amplifiers disclosed in documents D7 and D8 none of the transistors in the output stage is driven by the static component of the video signal AND its emitter is connected essentially directly to the first voltage supply which corresponds to the operating characteristics of the cathode ray tube.

Re Item VIII

Certain observations on the international application

In claim 1 (line 16) it is not clear what is meant by the term "...the collector load **for the static component** of the video signal..." contrary to the requirements of Article 6 PCT.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
16.669		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/DK 99/00579	22/10/1999	23/10/1998
Applicant		
BANG & OLUFSEN A/S et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 2

   [ ] as suggested by the applicant.

   [X] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [ ] None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/DK 99/00579

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H03F3/30 H04N5/14 H04N9/64

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H03F H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"Schaltungen zur Ansteuerung der Farbbildröhre" FUNKSCHAU, PART I, no. 21, 1987, page 60 XP002900931 page 60	1,4,5
A	---	2,3
X	"Schaltungen zur Ansteuerung der Farbbildröhre" FUNKSCHAU, PART II, no. 22, 1987, pages 83-86, XP002900932 the whole document	1,4,5
A	---	2,3
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 March 2000	19. 04. 2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Bo GustaVSSON

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"Schaltungen zur Ansteuerung der Farbbildröhre" FUNKSCHAU, PART III, no. 23, 1987, pages 53-56, XP002900933 the whole document	1,4,5
A	---	2,3
X	US 4 293 875 A (KATZ BERNARD R) 6 October 1981 (1981-10-06) column 2, line 18 -column 3, line 8 column 3, line 53 -column 4, line 48; figure 5	1-3
A	---	4,5
X	US 4 114 109 A (CAMPIONI ARMANDO) 12 September 1978 (1978-09-12) column 1, line 57 -column 3, line 53; figure 1	1,4
A	---	2,3,5
X	US 4 097 815 A (CAMPIONI ARMANDO) 27 June 1978 (1978-06-27) column 1, line 56 -column 3, line 60; figure 1	1,4
A	---	2,3,5
X	US 5 546 048 A (SANO YUJI ET AL) 13 August 1996 (1996-08-13) column 10, line 28 -column 11, line 53 column 16, line 40 -column 17, line 22 column 19, line 25 - line 56; figures 17,18,28,29	1,4
A	---	2,3,5
X	US 5 661 436 A (KRESOCK JOHN MICHAEL) 26 August 1997 (1997-08-26) column 2, line 18 -column 3, line 57; figure 1	1

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/DK 99/00579

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4293875 A	06-10-1981	NONE	
US 4114109 A	12-09-1978	IT 1032635 B	20-06-1979
		IT 1050564 B	20-03-1981
		DE 2614678 A	21-10-1976
		FR 2307397 A	05-11-1976
		GB 1544674 A	25-04-1979
		NL 7603493 A,B,	12-10-1976
		NL 9200949 A,B,	01-09-1992
		US 4097815 A	27-06-1978
US 4097815 A	27-06-1978	IT 1032635 B	20-06-1979
		IT 1050564 B	20-03-1981
		DE 2614678 A	21-10-1976
		FR 2307397 A	05-11-1976
		GB 1544674 A	25-04-1979
		NL 7603493 A,B,	12-10-1976
		NL 9200949 A,B,	01-09-1992
		US 4114109 A	12-09-1978
US 5546048 A	13-08-1996	JP 6085551 A	25-03-1994
		JP 6090463 A	29-03-1994
		JP 6245174 A	02-09-1994
		KR 133839 B	23-04-1998
US 5661436 A	26-08-1997	NONE	

A video output amplifier

The invention relates to a video output amplifier for conversion of an intensity signal consisting of a static and a dynamic component into a control voltage for an electron gun in a cathode ray tube, comprising a first voltage supply with a voltage corresponding to the operating characteristics of the cathode ray tube, an input terminal for the video signal and an output terminal for the control voltage. It is a purpose of the invention to provide a video output amplifier of this type in which the power loss is reduced considerably in comparison to known constructions in order that particular cooling means, such as cooling fins, may be avoided.

Cathode ray tubes (CRTs) are in general use in television receivers as well as in monitors for computer installations or personal computers, and video output amplifiers are used for driving such CRTs. Video output amplifiers are known and in practice comprise an output stage, the output terminal of which delivers a control voltage which is intended to control an electron beam in a CRT by modulating a suitably high voltage on the cathode. The bandwidth of the output signal is up to 5 MHz in generally known circuits for television. Discussions regarding television in the present text may be directly transferred to monitors and other equipment with a cathode ray tube.

The control voltage may be divided into two components: a static or only slowly varying component which contains the momentarily static intensities and slower intensity variations, and a dynamic component which contains the fast intensity variations. The input signal to the video output amplifier is provided by a signal processing circuit with output voltages in the range from +1 V to +6 V, while the output signal from the video output amplifer correspondingly is in the range +150 V to +50 V which means that a video output amplifier

for use in connection with television must have a supply voltage in the range +200 V. The fastest intensity variations in the output signal are ca. 100 V and occur in the course of ca. 100 ns which that a video output amplifier must be capable of delivering fairly large capacitive currents to the stray capacitances which load the output terminal which in its turn requires the quiescent current in amplifiers with class A output stages to be comparatively high.

The power loss in a class-A output stage is high. The comparatively high quiescent current combined with the high supply voltage cause the total power loss in the output stage to be high, and it becomes necessary to utilise external cooling means, such as cooling fins. In case the bandwidth of the video signal increases to e.g. 10 MHz, which is necessary in flicker-free television, where the deflection frequency is doubled, the power loss is correspondingly increased in a class-A output stage, and it is hence still more desirable to reduce the quiescent current in the output stage. To this end one may use e.g. a class-B output stage where an improvement may be obtained. One measure of the improvement may be the degree of increase in the proportion between the bandwidth of the video signal and the power loss of the video output amplifier used, and in class-B there is in practice obtained a halving of the power loss for a given bandwidth. Another measure of the improvement may be expressed as the reduction of the area below a curve which represents power drained from the voltage supply during a prescribed time function for the driving.

In certain and normally undesirable signal situations, such as noise from an empty television channel, the dynamically caused power losses in class-B may increase considerably, which together with the required increase in bandwidth cause even such solutions to require special cooling means. It is hence the purpose of the invention to provide an ampli-

fier circuit which displays considerably reduced quiescent power losses in comparison to known constructions, in order that special cooling means may be avoided.

This is obtained in a particular manner according to the invention in that the output of the control voltage is connected to the collector of at least one output transistor, that the emitter of the same transistor is connected essentially directly to the first voltage supply, and that the base is driven at a level adapted to the supply voltage. Thereby it is in particular obtained that the power loss is reduced because a part of the quiescent current is constituted by the current which must run anyway in the feedback resistor. The expression "essentially directly" is to be understood such that there may be one or more circuit elements provided between the emitter and the source for supply voltage, e.g. for linearisation or frequency compensation. Furthermore the invention may be realised by means of any amplifying element which is suitable for the particular frequency range, such as an FET, a MOSFET or similar, where "base" is in general to be understood as "control electrode".

An advantageous embodiment is particular in that the base of the output transistor is driven via the collector of a further transistor, the base of which is connected to reference voltage at a low voltage level, and the emitter of which is supplied with the static component of the control signal as a current from a driver amplifier. Hereby it is obtained that the control signal for the static component is lifted to the correct base bias voltage for the output transistor. The dynamic component is predominantly supplied via a coupling capacitor.

A further particular embodiment is characterised in that the operating point for the further transistor is adjusted so that further to the static component it additionally supplies rectified dynamic components to the base of the output tran-

sistor for the control of its dynamic output current for charging any stray capacitances present. Thereby it is obtained that the rectified dynamic components which would otherwise have been supplied via C4 do not cause a reversal of the charge of C4 which would otherwise manifest itself as long streaks following image sequences with many fast contrast jumps.

A further particular embodiment is characterised in that a second output transistor is driven in such a way that the discharge current is drawn out of stray capacitances present during negative jumps in the dynamic signal component. The second output transistor is biased such that it does not draw any appreciable quiescent current.

In particular the large difference between peak power and quiescent power may necessitate the use of a power limiting circuit, because a video signal which contains many contrast jumps, such as white noise on the input terminal, would be able to overload a circuit which due to the large power savings according to the invention has been made less bulky and with weaker cooling means. Ordinary signals would not be influenced by such a power limiting circuit. Hence a further particular embodiment is characterised in that a continuing large number of fast and strong dynamic intensity variations activate a current limiting function which limits the dynamic control currents to one or both output transistors, such that the maximum average power loss is limited to a level where there is no need for particular cooling means.

The invention will be described in greater detail in the following with reference to the drawing, in which

Fig. 1 is a schematic block diagram for video circuits comprising an output amplifier with a high supply voltage according to prior art,

Fig. 2 shows an embodiment according to the invention,

Fig. 3 shows an embodiment with a changed driver stage and an output buffer stage,

Fig. 4 shows a test signal which has been used to determine the power consumption in different amplifier constructions,

Fig. 5 shows the modelling of the power consumption from the voltage supply to a known construction based on a class-A amplifier, and

Fig. 6 shows the modelling of the power consumption for a construction according to the invention.

In Fig. 1 is shown a block diagram for a part of a television receiver or video monitor. In block 1 those signals are processed which are to drive the individual electron guns in a CRT. There are three output terminals corresponding to the three colours of phosphor which are to be activated, and each output terminal is controlled as to instantaneous light intensity. We are dealing with a signal which gives extremely fast transients with respect to slowly varying base levels, as one particular dot of phosphor on the screen may be totally black while its neighbour on the same line may have full intensity.

Amplification of the signals for use at the CRT in block 3 occurs in three identical video output amplifiers 2 to the colours R, G, and B. In the present embodiment for the prior art the CRT is driven at the cathode, but with suitable bias voltages and a phase reversal of the output signal it can equally be a control grid which is driven. Here only the conditions pertaining to the colour G will be described. The G signal from the circuit 1 is taken to the base of the driver transistor DTr which obtains its current from a low voltage supply. From the emitter an in-phase signal is taken to the output transistor TR which obtains it current supply from a relatively high voltage via a collector resistor Rc, corresponding to the requirements of the CRT. The local components

required by a practical circuit for adjusting the operating point of the driver transistor are not shown. The operating range of the video output amplifier is in practice adjusted by an adjustment by means of an adjustment in the signal processing circuit in block 1, in the form a manual "cut-off" adjustment during manufacture or by means of a control loop so that it corresponds to the CRT used. In this construction both the DC or slowly varying component and the high frequency content are transferred. When the amplifier in the active range of the CRT must be both linear and have a large bandwidth, the transistor TR is driven in class-A. This causes a quiescent current which is large according to the circumstances, and in combination with the high voltage droop across the output stage this causes a high quiescent power consumption - in practice for this type of output amplifier in the order of 2 W in case of typical television image information.

In Fig. 2 is seen an embodiment of the invention in the form of a G video output amplifier comprising the supply voltage indicated as 200 V, an input terminal and an output terminal for driving the CRT. The input signal is fed via a summing resistor R2 to the positive terminal of a voltage follower IC1, which i.a. provides a low impedance driver stage for the output transistor TR3 via the coupling capacitor C4. Simultaneously IC1 is also the driver stage for the dynamic component to TR2. IC1 receives its power from a low voltage supply which is not shown. The emitter of transistor TR3 is connected directly to the voltage supply, and the output voltage is taken from the collector. The same signal is taken to negative feed-back via the resistor R3 to the point of summation on the positive input terminal of the voltage follower IC1. From an AC point of view the supply voltage is at signal ground, and the transistor TR3 may hence dynamically be seen as a "grounded emitter". The transistor TR1 converts the output voltage from the driver stage IC1 into a

control current which is taken to the base of transistor TR3. As the voltage on the output terminal of the voltage follower IC1 is largely identical to the voltage at the summation point on its input terminal, which contains the negatively fed-back signal, the operating point of TR1 may be adjusted by means of R8 and R10, so that the control current contains both the static control current and the rectified part of the dynamic control current required by TR3, whereby non-intended reversals of charge of C4 are avoided.

The output transistor TR3 delivers the required DC current to maintain the DC potential on the output terminal. Furthermore TR3 delivers the charging current to the stray capacitances (in the order of 15 pF) during positive voltage steps, because it draws the discharge current out of the stray capacitances. This construction has been used rather than a passive connection to ground, because the quiescent current may then be kept at a low value in the order of 1 mA, while the charge reversal current to the stray capacitances may reach 15 mA. TR2 is provided with a signal from the driver stage IC1 via the coupling capacitor C3. D1, R17 and R18 establish a temperature compensated bias on the basis of TR2. The bias and R18 are determined so that the quiescent current in TR2 is maintained in the order of 1 mA mentioned and such that the bias on the base of TR2 may be influenced in the negative direction by the increasing control current which appears during many fast intensity variations. Thereby the control current to T2 is limited and hence the dynamically determined power losses in order that no need for special cooling means arises. C3 is adjusted so that the time constant for the power limiting becomes large enough so that short series of fast intensity variations within a frame do not cause limiting. In practice the skilled person will fit linearising resistors in suitable places as well as current limiting resistors. Furthermore, a practical circuit would comprise a

cut-off control loop, the function of which does not interfere with the present invention.

IC1 may advantageously be connected so that it provides a given voltage amplification, which gives a possibility of elevating the upper cut-off frequency of the video output amplifier.

In Fig. 3 is seen a video output amplifier according to the invention which is essentially identical in its function to that described with respect to Fig. 2. The difference is that the voltage follower IC1 is replaced by the emitter follower TR6 with the emitter resistance R4, and that there is added a buffer stage in the output consisting of the two transistors TR5 and TR4 with the zener diode D2. Furthermore there is shown a connection BCFB for beam current feedback.

In case the requirement for amplification and bandwidth is moderate it is sufficient to use an emitter follower TR6 as a driver. With an increase in the requirements it may be advantageous to use a discrete transistor amplifier with a certain voltage amplification as a driver in stead of the emitter follower TR6, and it may be further advantageous to comprise a limiter function in the transistor amplifer in such a way that the control current for TR3 is limited in the same way that the control current to TR2 is limited, cf. the description concerning Fig. 2.

It may be advantageous to include a buffer stage in the output of the amplifier, in particular if there is already a cut-off transistor, in that the dynamic power losses may be distributed among four transistors rather than among only two. In the circuit of Fig. 3 TR4 functions as a cut-off transistor most of the time, where the slowly varying beam currents from the CRT are taken through TR4 to the video signal processing circuit via the terminal marked BCFB. During fast intensity variations TR4 functions as a buffer, because a part of the stray capacitances are discharged via TR4 and

D2 to ground. The zener voltage on D2 is chosen such that the beam current is fed to the video signal processing circuit and not to ground. It is obvious that other voltage limiter circuits may perform the same function. TR5 is without current most of the time but it acts as a buffer during fast positive intensity variations where it charges a part of the stray capacitances.

In Fig. 4a is seen a test signal which is used in modelling a 5 MHz amplifier. The signal consists of two pulses with risetimes of ca. 100 ns, in that the pulses start from black and reach 50% and 100% maximum signal. The total duration of the test signal is ca. 3.5 µs, and it may be provided repetitively from a signal generator. The voltage amplitude on the input is 1 V and 2 V, respectively. The corresponding output signal is shown in Fig. 4b and goes from an output voltage of 160 V and falls during the two pulses to 110 V and 55 V, respectively. The signal is hence in reverse phase with respect to the input signal and is intended for cathode control of the CRT.

In Fig. 5 is shown the power consumption from the voltage supply of a 5 MHz output stage in class-A during the pulses, and it will be noted that the quiescent power is 1 W (black), and that the power consumption rises to 2 W (50% intensity) and 3.5 W (max. intensity) during the pulse cycle. As a measure of the power consumption it may be judged that the area below the curve is 6.5 µWs, i.e. the energy consumed during a pulse cycle. The power taken from the low voltage power supply is not taken into consideration.

In Fig. 6 is similarly shown the power consumption from the voltage supply of a 5 MHz output stage according to the invention. It is seen that the quiescent power consumption is ca. 0.25 W and that the power consumption is very low during the whole cycle, except where the output voltage (Fig. 4b) is

intended to rise with a steep flank towards the quiescent value. Hereby power surges of 1.7 W and 3.2 W, respectively, are obtained. These peaks are hence up to 12 times the quiescent power consumption. The area below the curve may be judged to be 0.3 μWs, i.e. an improvement of more than 20 times with respect to prior art expressed as a class-A stage. In a practical amplifier 8-10 times may be obtained. The power taken from the low voltage power supply is not taken into consideration in this case either.

Video output amplifiers according to the invention will be suitable for integration due to the small power consumption.

PATENT CLAIMS

1. A video output amplifier for conversion of an intensity signal consisting of a static and a dynamic component into a control voltage for an electron gun in a cathode ray tube, comprising a first voltage supply with a voltage corresponding to the operating characteristics of the cathode ray tube, an input terminal for the video signal and an output terminal for the control voltage, characterised in that the output of the control voltage is connected to the collector of at least one output transistor (TR3), that the emitter of the same transistor is connected essentially directly to the first voltage supply, and that the base is driven at a level adapted to the supply voltage.

2. A video output amplifier according to claim 1, characterised in that the base of the output transistor (TR3) is driven via the collector of a further transistor (TR1), the base of which is connected to a reference voltage (Vref) at a low voltage level, and the emitter of which is supplied with the static component of the control signal as a current from a driver amplifier (IC1, TR6).

3. A video output amplifier according to claim 2, characterised in that the operating point for the further transistor (TR1) is adjusted so that further to the static component it additionally supplies rectified dynamic components to the base of the output transistor (TR3) for the control of its dynamic output current for charging any stray capacitances present.

4. A video output amplifier according to claim 1, characterised in that a second output transistor (TR2) is driven in such a way that the discharge current is drawn out of stray capacitances present during negative jumps in the dynamic signal component.

5. A video output amplifier according to any of the above claims,

c h a r a c t e r i s e d i n that a continuing large number of fast and strong dynamic intensity variations activate a current limiting function which limits the dynamic control currents to one or both output transistors (TR2, TR3).

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REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No. PCT/DK 99/00579

International Filing Date 20/DK 22 OCTOBER 1999

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* 16.669

Box No. I TITLE OF INVENTION

A video output amplifier.

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

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☐ This person is also inventor.

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Facsimile No.

Teleprinter No.

State *(that is, country)* of nationality: DK Denmark

State *(that is, country)* of residence: DK Denmark

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

JENSEN, Erik Albert
Baunehøj 22
DK-7600 Struer
Denmark

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: DK Denmark

State *(that is, country)* of residence: DK Denmark

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

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Box No.V DESIGNATIC STATES

The following designations are he made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

- ☒ AP **ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SL Sierra Leone, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT**
- ☒ EA **Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT**
- ☒ EP **European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT**
- ☒ OA **OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT** *(if other kind of protection or treatment desired, specify on dotted line)* .....

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

- ☒ AE United Arab Emirates
- ☒ AL Albania .....
- ☒ AM Armenia .....
- ☒ AT Austria Patent and Util.Mod
- ☒ AU Australia .....
- ☒ AZ Azerbaijan
- ☒ BA Bosnia and Herzegovina .....
- ☒ BB Barbados
- ☒ BG Bulgaria .....
- ☒ BR Brazil .....
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- ☒ CA Canada
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- ☒ CN China .....
- ☒ CU Cuba .....
- ☒ CZ Czech Republic Patent and Util.Mod
- ☒ DE Germany Patent and Util.Mod
- ☒ DK Denmark Patent and Util.Mod
- ☒ EE Estonia Patent and Util.Mod
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- ☒ FI Finland Patent and Util.Mod
- ☒ GB United Kingdom
- ☒ GD Grenada
- ☒ GE Georgia .....
- ☒ GH Ghana .....
- ☒ GM Gambia
- ☒ HR Croatia .....
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- ☒ ID Indonesia
- ☒ IL Israel .....
- ☒ IN India .....
- ☒ IS Iceland
- ☒ JP Japan .....
- ☒ KE Kenya .....
- ☒ KG Kyrgyzstan .....
- ☒ KP Democratic People's Republic of Korea .....
- ☒ KR Republic of Korea .....
- ☒ KZ Kazakhstan .....
- ☒ LC Saint Lucia
- ☒ LK Sri Lanka
- ☒ LR Liberia
- ☒ LS Lesotho .....
- ☒ LT Lithuania
- ☒ LU Luxembourg
- ☒ LV Latvia
- ☒ MD Republic of Moldova .....
- ☒ MG Madagascar .....
- ☒ MK The former Yugoslav Republic of Macedonia .....
- ☒ MN Mongolia
- ☒ MW Malawi .....
- ☒ MX Mexico .....
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- ☒ PL Poland .....
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- ☒ SI Slovenia .....
- ☒ SK Slovakia Patent and Util.Mod
- ☒ SL Sierra Leone .....
- ☒ TJ Tajikistan .....
- ☒ TM Turkmenistan .....
- ☒ TR Turkey .....
- ☒ TT Trinidad and Tobago .....
- ☒ UA Ukraine .....
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Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

- ☒ TZ Tanzania .....
- ☒ MA Morocco .....

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)*

Box No. VI PRIORITY CLAIM ☐ Further priority claims are indicated in the Supplemental Box.

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is: national application: country	regional application:* regional Office	international application: receiving Office
item (1) 23.10.1998	PA 1998 01371	DK Denmark		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): PA 1998 01371

* *Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used)*: ISA / EPO

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority)*:
Date *(day/month/year)* Number Country *(or regional Office)*

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following **number of sheets**:

request	:	3
description (excluding sequence listing part)	:	9
claims	:	2
abstract	:	1
drawings	:	5
sequence listing part of description	:	
Total number of sheets	:	20

This international application is **accompanied** by the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☒ other *(specify)*: DK PO Search Report of 21.10.1999

Figure of the drawings which should accompany the abstract:

Language of filing of the international application: Danish

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

K. Skøtt-Jensen

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1. Date of actual receipt of the purported international application: RO/DK 22 OCTOBER 1999 (22.10.99)
2. Drawings: ☐ received: ☐ not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:
4. Date of timely receipt of the required corrections under PCT Article 11(2):
5. International Searching Authority (if two or more are competent): ISA / EPO
6. ☐ Transmittal of search copy delayed until search fee is paid.

For International Bureau use only

Date of receipt of the record copy by the International Bureau: 08 NOVEMBER 1999 (08. 11. 99)

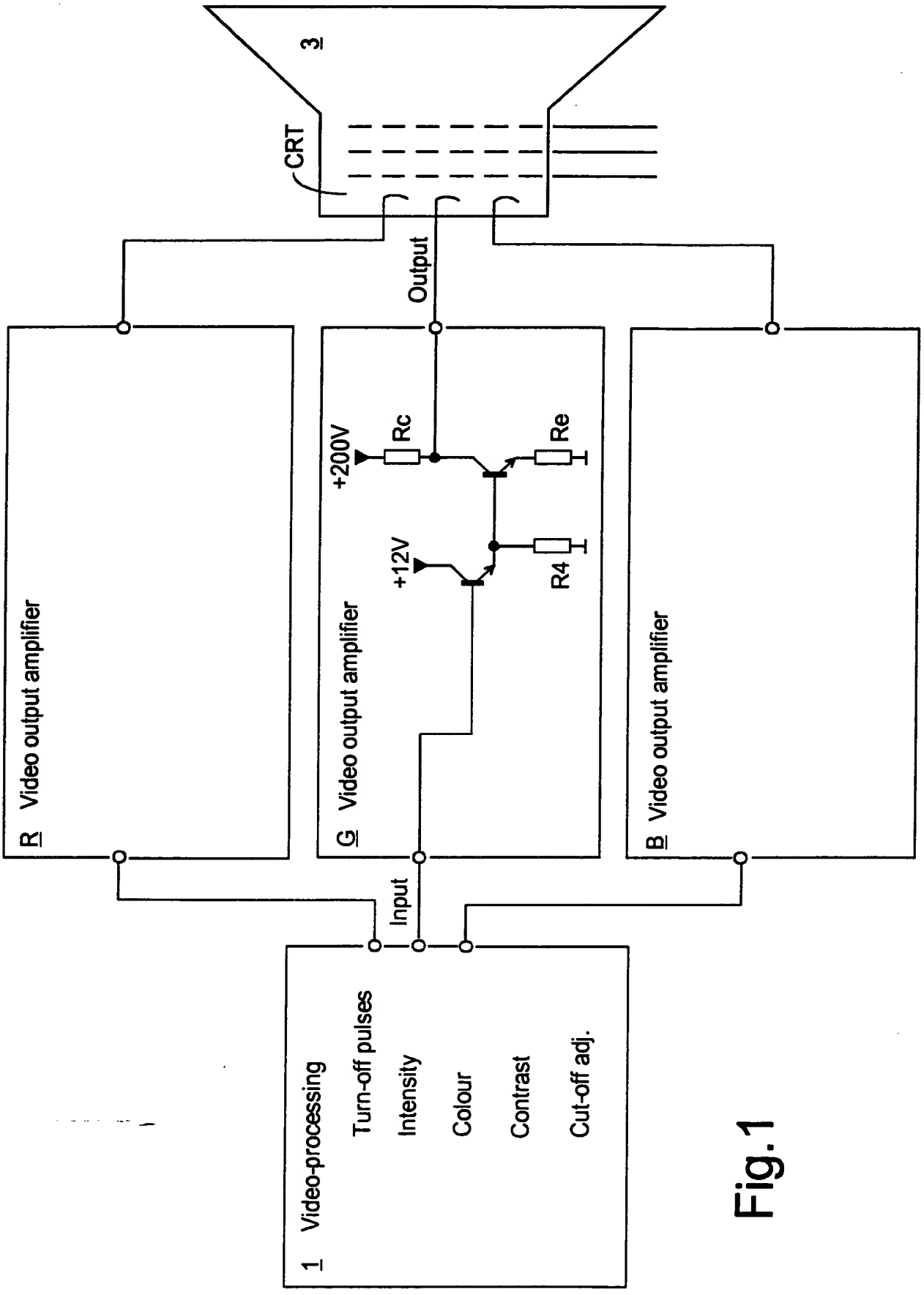
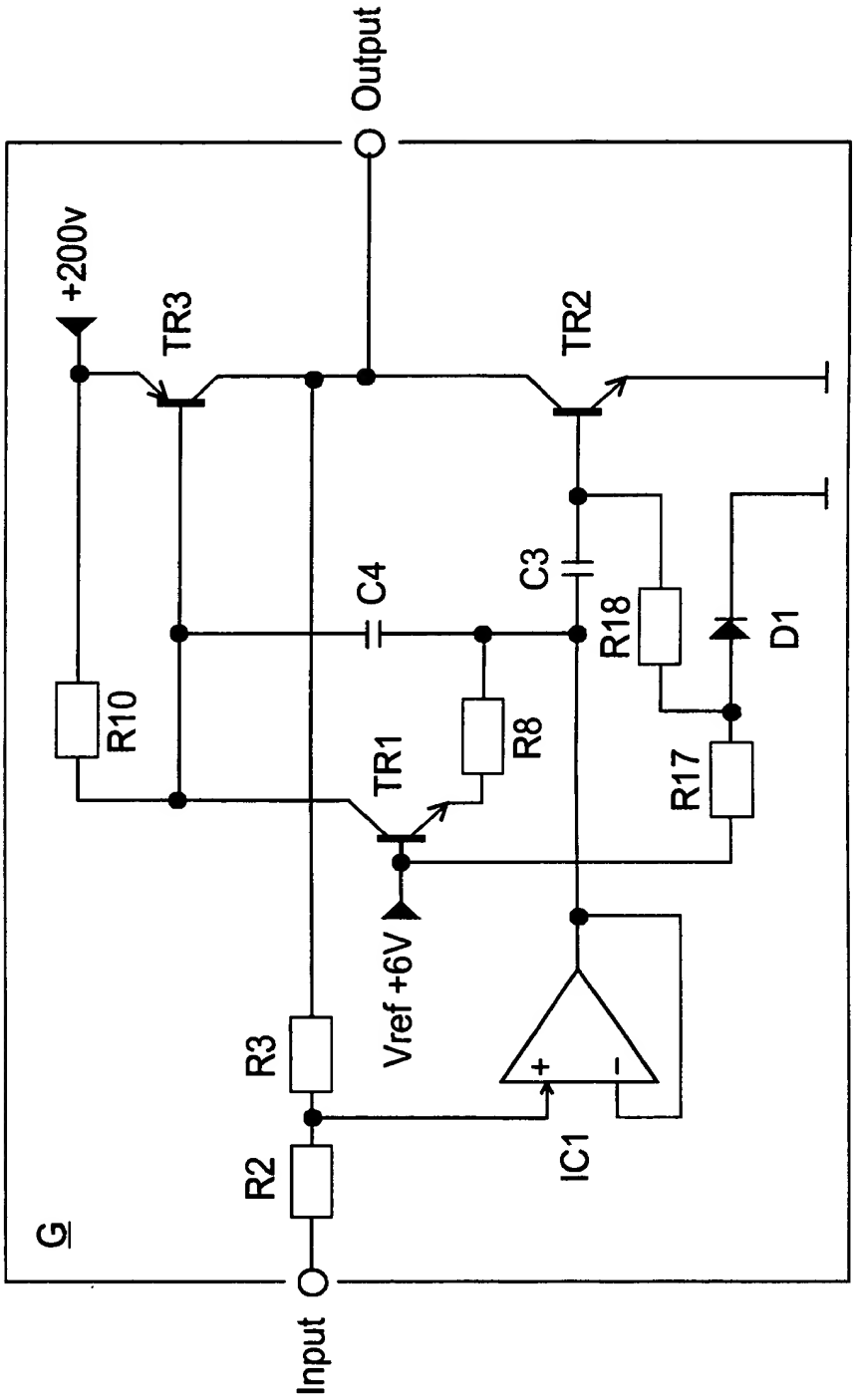

3
CRT
Output
+200V
Rc
Re
+12V
R4
R Video output amplifier
G Video output amplifier
B Video output amplifier
Input
1 Video-processing
Turn-off pulses
Intensity
Colour
Contrast
Cut-off adj.

Fig.1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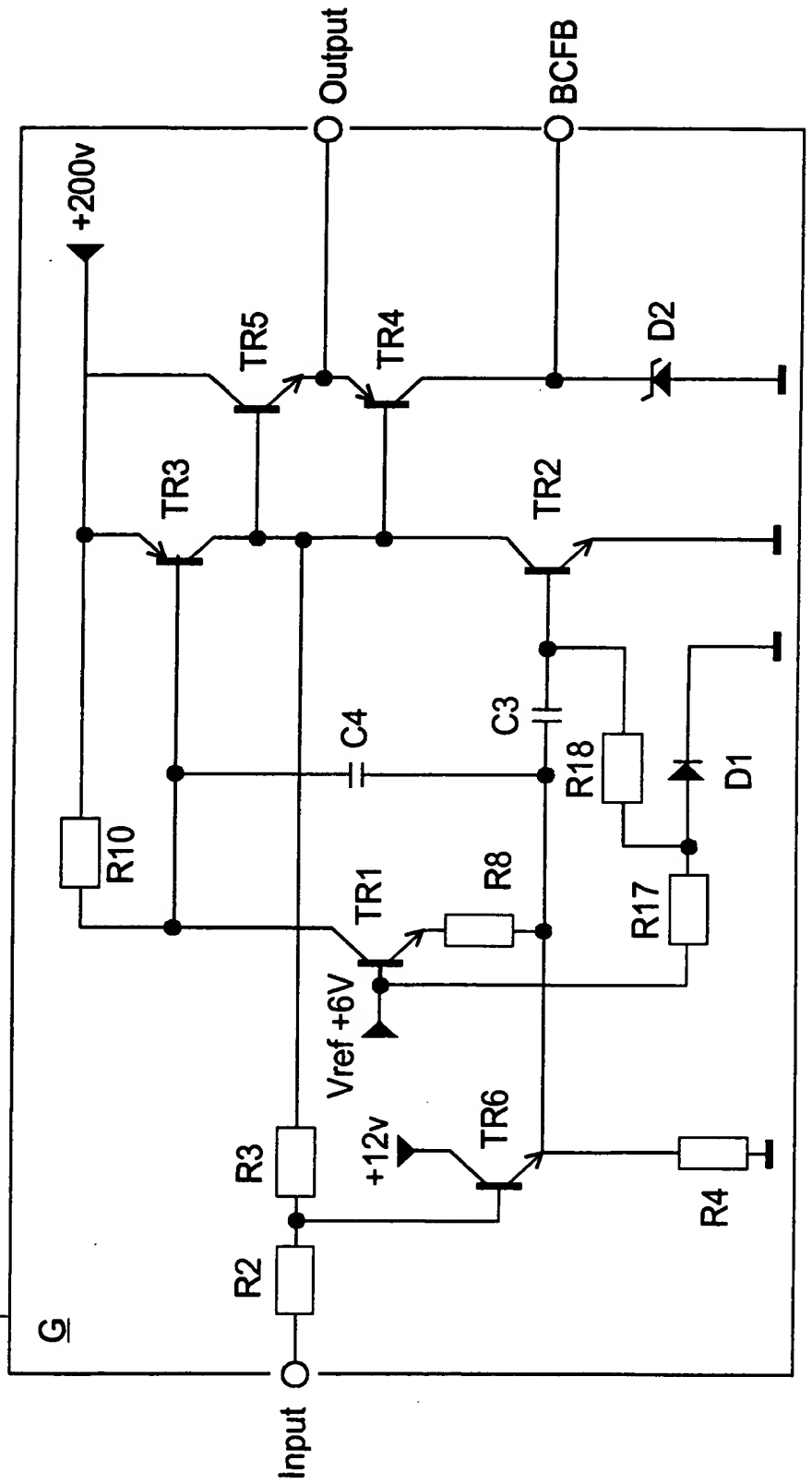
TR3
TR2
C4
C3
R18
D1
R10
R8
TR1
R17
Vref +6V
R3
IC1
R2
G
Input

Fig.2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TR5
TR4
D2
TR3
TR2
C4
C3
R18
D1
R10
TR1
R8
R17
Vref +6V
TR6
+12v
R3
R4
R2
G
Input

Fig.3

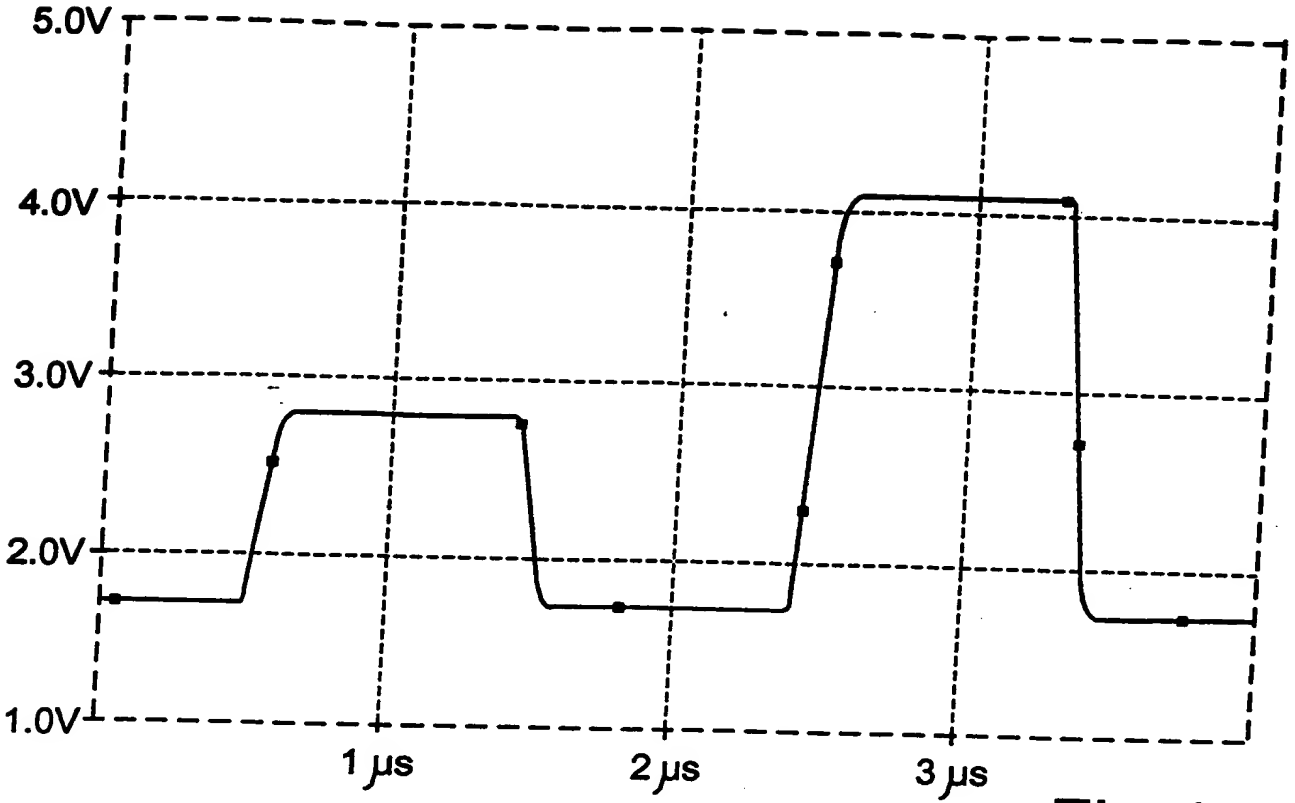

Fig.4a

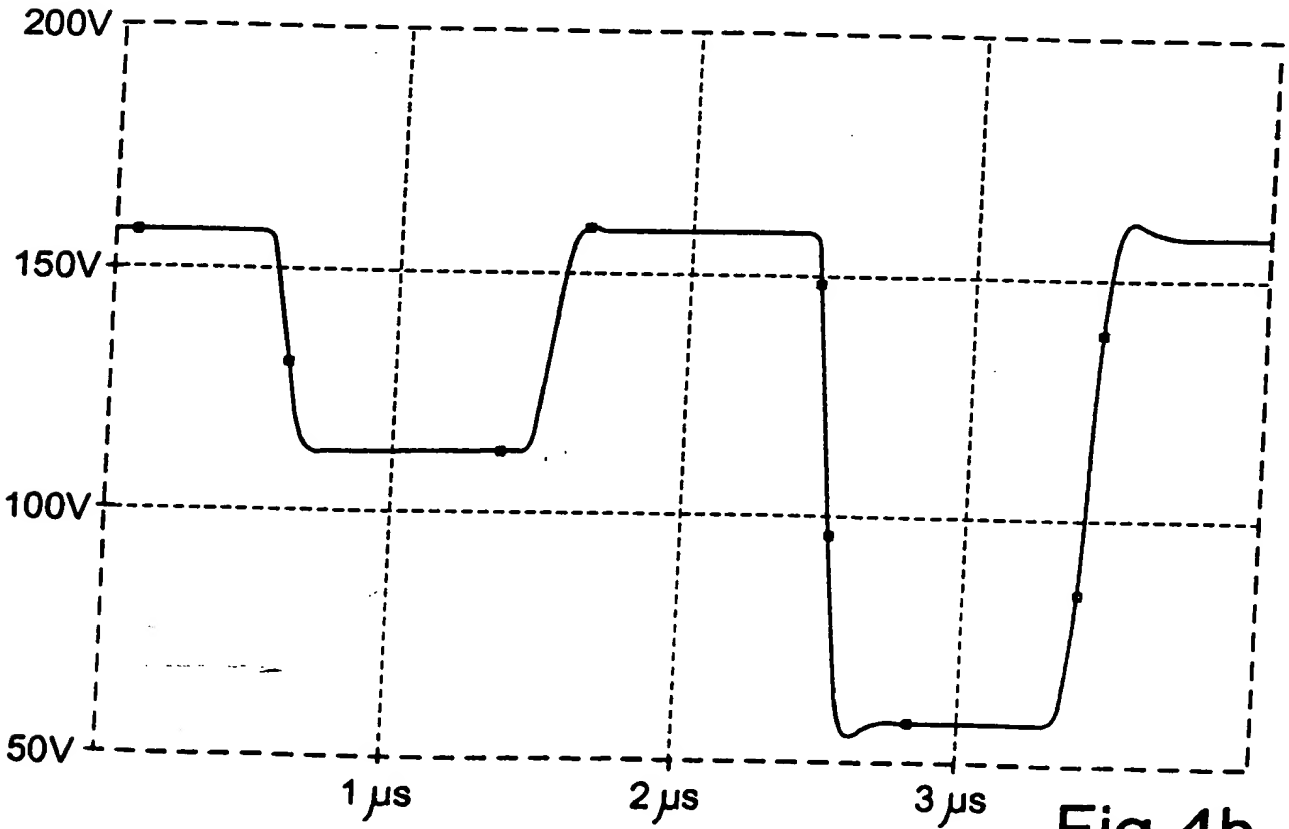

Fig.4b

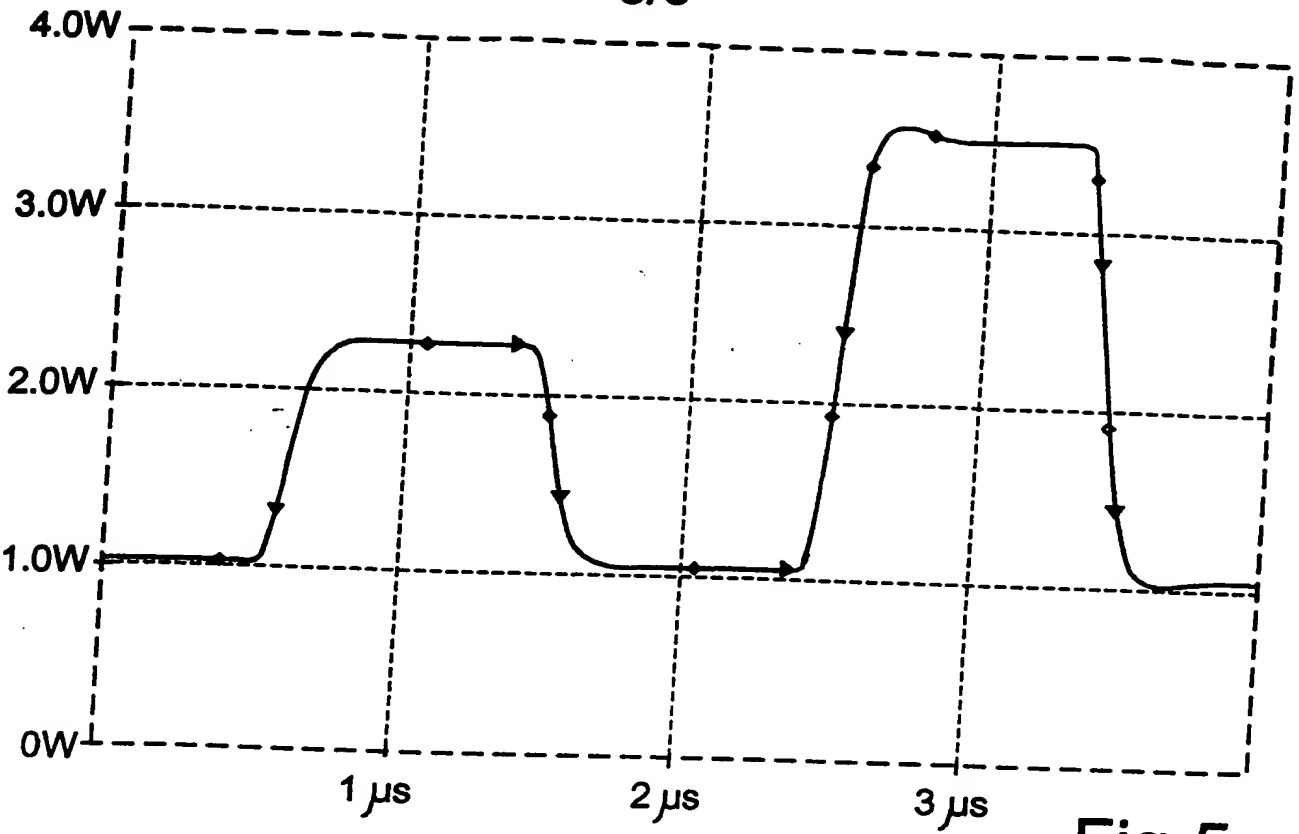

Fig.5

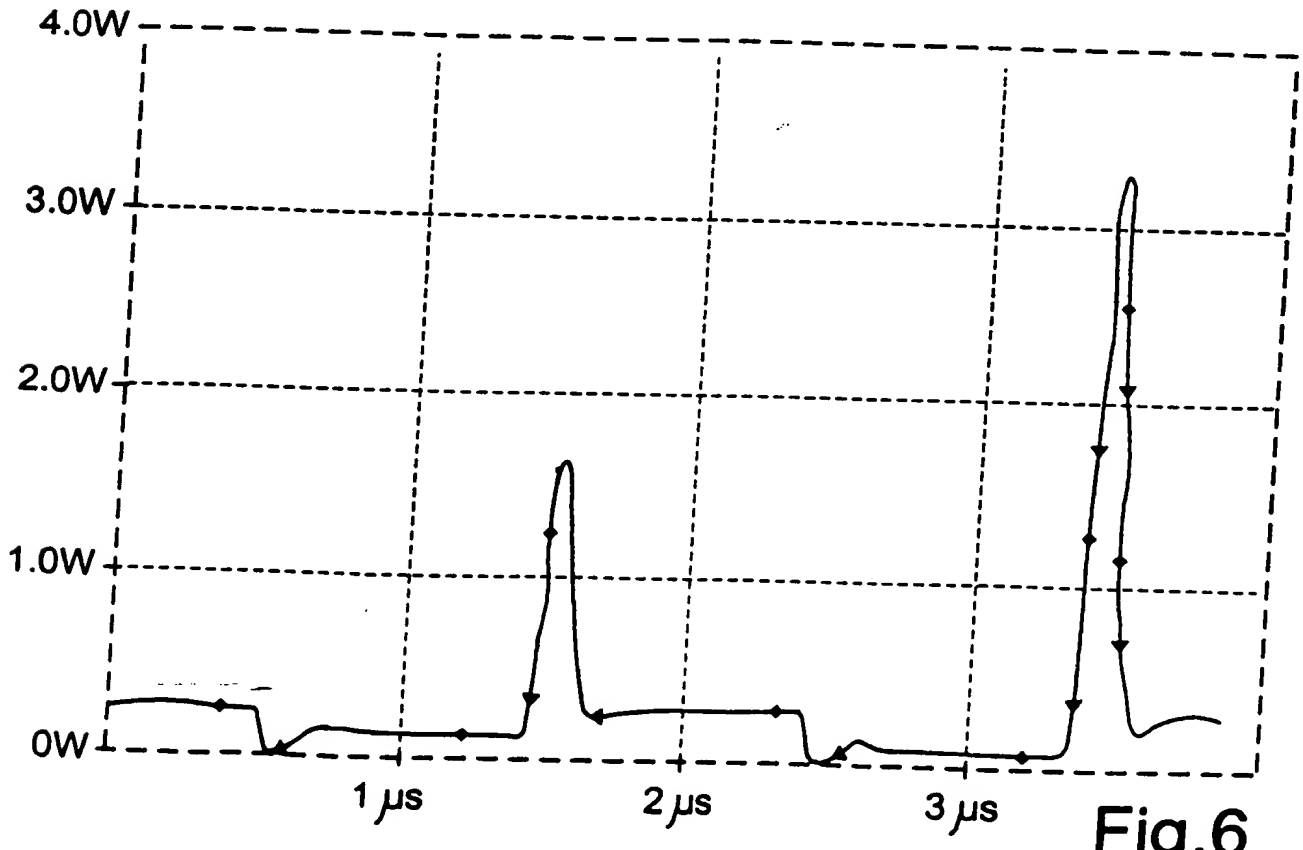

Fig.6

En videoudgangsforstærker.

Opfindelsen vedrører en videoudgangsforstærker til omsætning af et intensitetssignal bestående af en statisk og en dynamisk komponent til en styrespænding for en elektronkanon i et billedrør, omfattende en første spændingsforsyning med en spænding svarende til billedrørets driftsparametre, en indgang for videosignalet og en udgang for styrespændingen. Det er formålet med opfindelsen at tilvejebringe en videoudgangsforstærker af denne type, hvor tabseffekten er reduceret markant i forhold til kendte konstruktioner, så særlige kølemidler, såsom kølefinner kan undgås.

Billedrør er alment benyttet i såvel TV-apparater som i monitorer til computeranlæg eller personlige computere, og videoudgangsforstærkere benyttes til at drive sådanne billedrør. Videoudgangsforstærkere er kendt og omfatter i praksis et udgangstrin, hvis udgang afgiver en styrespænding, som skal styre en elektronstråle i et billedrør ved at modulere en passende høj spænding på katoden. Båndbredden på udgangssignalet er i alment kendte kredsløb for TV op til 5 MHz. Det, som i nærværende tekst omtales vedrørende TV kan umiddelbart overføres til monitorer og andre apparater med katodestrålerør.

Styrespændingen kan deles i to komponenter: en statisk eller kun langsomt varierende komponent, som indeholder de momentant statiske intensiteter og de langsomme intensitetsvariationer, og en dynamisk komponent, som indeholder de hurtige intensitetsvariationer. Indgangssignalet til videoudgangsforstærkeren leveres af et signalbehandlingskredsløb med udgangsspændinger i området fra +1 til +6 V medens udgangssignalet fra videoudgangsforstærkeren modsvarende ligger i området +180 til +50 V, hvilket betyder, at en videoudgangsforstærker til brug i TV-sammenhæng skal have en spændingsforsyning af størrelsesordenen +200 V. De største hurtige in-

tensitetsvariationer i udgangssignalet ligger på ca. 100 V og forløber i løbet af ca. 100 ns, hvilket medfører, at en videoudgangsforstærker skal kunne levere relativt store kapacitive strømme til spredningskapaciteterne, som belaster udgange, hvilket igen medfører, at hvilestrømmen i alment kendte forstærkere med klasse-A udgangstrin skal være forholdsvis stor.

Effekttabet i et klasse-A udgangstrin er højt. Den forholdsvis høje hvilestrøm medfører sammen med den høje forsyningsspænding, at den samlede tabseffekt i udgangstrinnet bliver høj, så det bliver nødvendigt med udvendige midler til køling, f.eks. kølefinner. Dersom videosignalets båndbredde øges, f.eks. til 10 MHz, hvilket er nødvendigt ved flickerfree TV, hvor afbøjningsfrekvensen fordobles, øges tabseffekten tilsvarende i et klasse-A udgangstrin, og det er derfor yderligere ønskeligt at nedsætte hvilestrømmen i udgangstrinnet. Med dette formål vil man f.eks. kunne bruge et klasse-B udgangstrin, hvor man kan opnå en forbedring. Et mål for forbedringen kan være graden af forøgelse i forholdet mellem videosignalets båndbredde og den benyttede videoudgangsforstærkers tabseffekt, og for klasse-B opnås i praksis en halvering af tabseffekten ved en given båndbredde. Et andet mål for forbedringen kan udtrykkes som formindskelsen af arealet under en kurve, som repræsenterer optaget effekt fra spændingsforsyningen under et på forhånd fastlagt tidsforløb for udstyring.

I visse og normalt utilsigtede signalsituationer, som f.eks. støj fra en tom TV-kanal, kan de dynamisk betingede effekttab i klasse-B koblinger stige betragteligt, hvilket sammen med den krævede forøgelse af båndbredden gør, at også sådanne løsninger i praksis kræver særlige midler til køling. Det er således formålet med opfindelsen at frembringe en forstærkerkobling, som udviser betydeligt mindre hvilestrømstab end kendte konstruktioner, således at særlige midler til køling kan undgås.

Dette opnås på en for opfindelsen særegen måde ved, at udgangen for styrespændingen er forbundet med kollektoren på mindst én udgangstransistor, at emitteren for samme transistor er forbundet i det væsentlige direkte med den første spændingsforsyning, og at basis bliver udstyret på et niveau tilpasset spændingsforsyningens spænding. Herved opnås især, at effekttabet reduceres, ved at en del af hvilestrømmen i udgangstrinnet udgøres af den strøm, som i forvejen skal løbe i modkoblingsmodstanden Ved udtrykket "i det væsentlige direkte" skal forstås, at der kan være indskudt et eller flere kredsløbselementer mellem emitteren og kilden for forsyningsspænding, f.eks. til linearisering eller frekvenskompensation. Iøvrigt er opfindelsen ligeledes realiserbar med ethvert forstærkende element, som er velegnet i det pågældende frekvensområde, såsom en FET, MOSFET eller lignende, hvor "basis" helt alment skal opfattes som "styreelektrode".

En fordelagtig udførelsesform er særegen ved, at basis i udgangstransistoren udstyres via kollektoren på en yderligere transistor, hvis base er forbundet til en referencespænding på lavspændingsniveau, og hvis emitter får tilført den statiske komponent af styresignalet i form af en strøm fra en driverforstærker. Herved er det opnået, at styresignalet for den statiske komponent er løftet op til den korrekte basisforspænding for udgangstransistoren. Den dynamiske komponent tilføres hovedsageligt via en koblingskondensator.

En yderligere særegen udførelsesform er kendetegnet ved, at arbejdspunktet for den yderligere transistor er tilpasset således, at den foruden den statiske komponent også tilfører ensrettede dynamiske komponenter til basis af udgangstransistoren til styring af dennes dynamiske udgangsstrøm til opladning af forekommende spredningskapaciter. Herved opnås, at de ensrettede dynamiske komponenter, som ellers skulle tilføres via C4, ikke fører til en omladning af C4, hvilket ellers

ville vise sig som langstrakte slæb efter billedsekvenser med mange hurtige kontrastspring.

En yderligere særegen udførelsesform er kendetegnet ved, at en anden udgangstransistor udstyres på en sådan måde, at afladningsstrømmen trækkes ud af forekommende spredningskapaciteter ved negative spring i den dynamiske signalkomponent. Den anden udgangstransistor forspændes, således at den ikke trækker nogen væsentlig hvilestrøm.

Netop den store forskel mellem spidseffekt og hvileeffekt kan nødvendiggøre brugen af et effektbegrænserkredsløb, idet et videosignal, som rummer mange kontrastspring, f.eks. hvid støj på indgangen, vil kunne overbelaste et kredsløb, som i medfør af den store effektbesparelse ved opfindelsen er konstrueret mindre og med svagere kølemidler. Almindelige nyttesignaler vil ikke påvirkes af et sådant effektbegrænserkredsløb. Derfor er en yderligere særegen udførelsesform kendetegnet ved, at et vedvarende stort antal hurtige og kraftige dynamiske intensitetsændringer aktiverer en strømbegrænsningsfunktion, som begrænser de dynamiske styrestrømme til en eller begge udgangstransistorer, således at den maksimale gennemsnitlige tabseffekt begrænses til et niveau, hvor der ikke opstår behov for særlige kølemidler.

Opfindelsen vil blive forklaret nærmere i det følgende under henvisning til tegningen, hvor

Fig. 1 udgør et skematisk blokdiagram for videokredsløb omfattende en udgangsforstærker med høj spændingsforsyning ifølge kendt teknik,

Fig. 2 viser en udførelsesform ifølge opfindelsen,

Fig. 3 viser en udførelsesform med et ændret drivertrin og et udgangsbuffertrin,

Fig. 4 viser et prøvesignal, som er benyttet til at bestemme effektforbruget i forskellige forstærkerkonstruktioner,

Fig. 5 viser modellering af effektforbruget fra spændingsforsyningen til en kendt konstruktion baseret på en klasse-A forstærker,

Fig. 6 viser modellering af effektforbruget for en konstruktion ifølge opfindelsen.

På Fig. 1 ses et blokdiagram for en del af en TV-modtager eller videomonitor. I blok 1 signalbehandles de signaler, som skal benyttes til at drive de individuelle elektronkanoner i et billedrør. Der er tre udgange, svarende til de tre farver på fosfor, som skal aktiveres, og hver udgang styres med hensyn til øjeblikkelig lysintensitet. Det drejer sig om et signal, som omkring langsomt varierende grundniveauer giver ekstremt hurtige transienter, idet en given fosforprik på billedskærmen kan være helt sort, medens det tilstræbes, at dens nabo i samme farve i samme linie kan have fuld intensitet. Forstærkning af signalerne til brug ved billedrøret i blok 3 foregår i tre ens videoudgangsforstærkere 2, til farverne R, G og B. I nærværende udførelsesform for den kendte teknik er billedrøret udstyret på katoden, men ved passende forspændinger og fasevending af udgangssignalet kan det ligesåvel være et styregitter, der udstyres. Her skal kun beskrives forholdene vedrørende farven G. G-signalet fra kredsløbet 1 føres til basis på drivertransistoren DTr, som er strømforsynet fra en lav forsyningsspænding. Fra emitteren føres et signal i fase til udgangstransistoren TR, som strømforsynes via en kollektormodstand Rc til den relativt højspændte strømforsyning, som svarer til billedrørets behov. Der er ikke vist de lokale komponenter, som et praktisk kredsløb vil forlange til indstilling af arbejdspunkt for drivertransistoren. Selve arbejdsområdet for videudgangsforstærkeren er i praksis justeret ved en justering i signalbehandlingskredsløbet blok 1, i form af en manuel "cut-off"-justering ved fabrikationen eller ved en kontrolsløjfe, således at det passer til det benyttede billedrør. Ved denne konstruktion overføres der såvel DC el-

ler langsomt varierende spændinger som højfrekvensindholdet. Når forstærkeren i billedrørets aktive område skal være både lineær og have stor båndbredde, drives TR i klasse A. Dette medfører en efter omstændighederne stor hvilestrøm, hvilket kombineret med det store spændingsfald over udgangstrinnet medfører et stort effekttab i hvile - i praksis for denne type udgangsforstærker i størrelsesordenen 2 W ved typisk TV-billedinformation.

På Fig. 2 ses en udførelsesform for opfindelsen i form af en G-videoudgangsforstærker omfattende forsyningsspændingen angivet som 200 V, en indgang og en udgang til udstyring af billedrøret. Indgangssignalet fødes igennem en summationsmodstand R2 til den positive indgang af en spændingsfølger IC1, som bl.a. udgør et lavimpedanset drivertrin for udgangstransistoren TR3 via koblingskondensatoren C4. Samtidig udgør IC1 også drivertrin for den dynamiske komposant til TR2. IC1 forsynes fra en ikke-vist lavspændingsforsyning. Transistoren TR3 er koblet direkte til forsyningsspændingen med sin emitter, og udgangsspændingen tages fra kollektoren. Samme signal føres til modkobling via modstanden R3 til summationspunktet på den positive indgang af spændingsfølgeren IC1. Vekselspændingsmæssigt ligger forsyningsspændingen på stelpotentiale, og transistoren TR3 er derfor dynamisk set koblet som "jordet emitter". Transistoren TR1 omsætter udgangssignalet fra drivertrinnet IC1 til en styrestrøm, som tilføres basis af TR3. Idet spændingen på udgangen af spændingsfølgeren IC1 er stort set identisk med spændingen på summationspunktet på dens indgang, som jo rummer det modkoblede signal, kan arbejdspunktet for TR1 afstemmes med R8 og R10, således at styrestrømmen indeholder både den statiske styrestrøm og den ensrettede andel af den dynamiske styrestrøm, som TR3 har behov for, hvorved utilsigtede omladninger af C4 undgås.

Udgangstransistoren TR3 leverer den nødvendige DC-strøm til at opretholde DC-potentialet på udgangen. Desuden leverer

TR3 opladningsstrømmen til spredningskapaciteterne (i størrelsesordenen 15 pF) ved positive spændingsspring, medens TR2 bliver aktiv ved negative spændingsspring, idet den trækker afladningsstrømmen ud af spredningskapaciteten. Denne konstruktion er benyttet i stedet for en passiv forbindelse til stel, idet hvilestrømmen så kan holdes på en lav værdi af størrelsesordenen 1 mA, hvorimod omladningsstrømmen til spredningskapaciteterne kan nå op på 15 mA. TR2 forsynes med signal fra drivertrinnet IC1 via koblingskondensatoren C3. D1, R17 og R18 etablerer en temperaturkompenseret forspænding på basis af TR2. Forspændingen og R18 afpasses, således at hvilestrømmen i TR2 holdes i den omtalte størrelsesorden på 1 mA, og således at forspændingen på basis af TR2 kan påvirkes i negativ retning af den stigende styrestrøm, som fremkommer ved mange hurtige intensitetsvariationer. Derved begrænses styrestrømmen til TR2 og dermed de dynamisk foranledigede effekttab, så der ikke opstår et behov for særlige kølemidler. C3 afpasses, således at tidskonstanten for effektbegrænsningens intræden bliver tilpas stor, så korte serier af hurtige intensitetsvariationer indenfor et delbillede ikke giver anledning til begrænsning. I praksis vil fagmanden indsætte lineariseringsmodstande på passende steder, ligesom strømbegrænsningsmodstande vil være anvendt. Desuden vil et praktisk kredsløb rumme en cut-off reguleringssløjfe, hvis funktion ikke griber ind i nærværende opfindelse.

IC1 kan med fordel kobles, så den giver en vis spændingsforstærkning, hvilket giver mulighed for at hæve videoudgangsforstærkerens øvre grænsefrekvens.

På Fig. 3 ses en videoudgangsforstærker ifølge opfindelsen, som i det væsentlige er identisk i sin funktion med den under Fig. 2 beskrevne. Forskellen er, at spændingsfølgeren IC1 er erstattet af emitterfølgeren TR6 med emittermodstanden R4, og at der er tilføjet et buffertrin i udgangen bestående af to transistorer TR5 og TR4 med zenerdioden D2. Endvidere

er der vist en forbindelse BCFB til strålestrømstilbagekobling.

Dersom kravet til forstærkning og båndbredde er moderat, er det tilstrækkeligt at benytte en emitterfølger TR6 som drivertrin. Ved stigende krav kan det være fordelagtigt at anvende en diskret opbygget transistorforstærker med en vis spændingsforstærkning, som driver i stedet for emitterfølgeren TR6, og det kan yderligere være fordelagtigt at indbygge en begrænserfunktion i transistorforstærkeren på en sådan måde, at styrestrømmen til TR3 begrænses på samme måde som styrestrømmen til TR2 begrænses, jvf. ovenfor under beskrivelsen vedrørende Fig. 2.

Det kan være fordelagtigt at indføje et buffertrin i forstærkerens udgang, især hvis der i forvejen findes en cut-off transistor, idet de dynamiske tabseffekter så kan fordeles på fire transistorer i stedet for på blot to. I koblingen på Fig. 3 fungerer TR4 det meste af tiden som cut-off transistor, hvor de langsomt varierende strålestrømme fra billedrøret ledes igennem TR4 til videosignalbehandlingskredsløbet via terminalen mærket BCFB. Ved hurtige intensitetsvariationer virker TR4 som buffer, idet en del af spredningskapaciteterne aflades via TR4 og D2 til stel. Zenerspændingen på D2 afpasses således, at strålestrømmen ledes til videosignalbehandlingskredsløbet og ikke til stel. Det er indlysende, at andre spændingsbegrænserkoblinger kan udføre samme funktion. TR5 er strømløs det meste af tiden, men virker som buffer ved hurtige positive intensitetsvariationer, hvor den oplader en del af spredningskapaciteterne.

På Fig. 4a ses et prøvesignal, som er anvendt ved modellering af en 5 MHz forstærker. Signalet består af to pulser med stigetider på ca. 100 ns, idet pulserne udgår fra sort og når 50% og 100% maximumsignal. Den samlede varighed for prøvesignalet er ca. 3.5 µs, og kan frembringes repetitivt fra en signalgenerator. Spændingssvinget på indgangen er 1 V,

henholdsvis 2 V. Det hertil hørende udgangssignal er vist på Fig. 4b og går fra en udgangsspænding på 160 V og falder under forløbet af to pulser til henholdsvis 110 V og 55 V. Signalet er dermed i modfase med indgangssignalet og er beregnet til katodestyring af billedrøret.

På Fig. 5 ses effektforbruget fra spændingsforsyningen til et 5 MHz udgangstrin i klasse A under pulsforløbet, og det konstateres, at hvileeffekten er 1 W (sort), og at effektforbruget stiger til 2 W (50% intensitet) og 3,5 W (max. intensitet) under pulsernes forløb. Som mål for effektforbruget kan skønnes, at arealet under kurven er 6,5 µWs, dvs. energien forbrugt under et pulsforløb. Effektforbruget fra lavspændingsforsyningen er ikke taget i betragtning.

På Fig. 6 ses tilsvarende effektforbruget fra spændingsforsyningen til et 5 MHz udgangstrin ifølge opfindelsen. Det ses, at hvileeffektforbruget er på ca. 0,25 W, og at effektforbruget er meget lavt under hele forløbet, undtagen hvor udgangsspændingen (Fig. 4b) skal stige med stejl flanke imod hvileværdien. Her fremkommer effektspidser på 1,7 W, henholdsvis 3,2 W. Disse spidser er dermed op til 12 gange højere end hvileeffekten. Arealet under kurven kan skønnes at være 0,3 µWs, dvs. en forbedring på mere end en faktor 20 i forhold til den kendte teknik udtrykt ved et klasse A-trin. I en praktisk forstærker kan der opnås en faktor på 8 - 10. Effektforbruget fra lavspændingsforsyningen er heller ikke i dette tilfælde taget i betratning.

Videoudgangsforstærkere ifølge opfindelsen vil på grund af det ringe effektforbrug være velegnet til udførelse som integreret kreds.

P A T E N T K R A V

1. En videoudgangsforstærker til omsætning af et intensitetssignal bestående af en statisk og en dynamisk komponent til en styrespænding for en elektronkanon i et billedrør, omfattende en første spændingsforsyning med en spænding svarende til billedrørets egenskaber, en indgang for videosignalet og en udgang for styrespændingen, k e n d e t e g n e t v e d , at udgangen for styrespændingen er forbundet med kollektoren på mindst én udgangstransistor (TR3), at emitteren for samme transistor er forbundet i det væsentlige direkte med den første spændingsforsyning, og at basis bliver udstyret på et niveau tilpasset spændingsforsyningens spænding.

2. Videoudgangsforstærker ifølge krav 1, k e n d e t e g n e t v e d , at basis i udgangstransistoren (TR3) udstyres via kollektoren på en yderligere transistor TR1), hvis base er forbundet til en referencespænding (Vref) på lavspændingsniveau, og hvis emitter får tilført den statiske komponent af styresignalet i form af en strøm fra en driverforstærker (IC1, TR6).

3. Videoudgangsforstærker ifølge krav 2, k e n d e t e g n e t v e d , at arbejdspunktet for den yderligere transistor (TR1) er afstemt således, at den foruden den statiske komponent også tilfører ensrettede dynamiske komponenter til basis af udgangstransistoren (TR3) til styring af dennes dynamiske udgangsstrøm til opladning af forekommende spredningskapaciter.

4. Videoudgangsforstærker ifølge krav 1, k e n d e t e g n e t v e d , at en yderligere udgangstransistor (TR2) udstyres på en sådan måde, at afladningsstrømmen trækkes ud af forekommende spredningskapaciteter ved negative spring i den dynamiske signalkomponent.

5. Videoudgangsforstærker ifølge ethvert af de ovenstående krav 1, k e n d e t e g n e t ved, at et vedvarende

stort antal hurtige og kraftige dynamiske intensitetsændringer aktiverer en strømbegrænserfunktion, som begrænser de dynamiske styrestrømme til en eller begge (TR3, TR2) udgangstransistorer.

A video output amplifier.

A B S T R A C T

Output amplifiers for driving picture tubes need to provide a high slew rate, and traditional class-A amplifiers have a high quiescent power consumption because of the high supply voltage combined with the necessary high quiescent current. According to the invention, the quiescent current is constituted mainly of the DC feedback current in the output device (TR3), and its control electrode is driven by means of a transistor (TR1), whose base has a reference potential, and whose emitter receives the static component of the control signal for the picture tube. In one embodiment the quiescent power consumption is 10-15% of that of a corresponding class-A amplifier, and the required cooling means may be considerably reduced.

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : H03F — A2

(11) International Publication Number: **WO 00/25420**

(43) International Publication Date: 4 May 2000 (04.05.00)

(21) International Application Number: PCT/DK99/00579

(22) International Filing Date: 22 October 1999 (22.10.99)

(30) Priority Data:
PA 1998 01371 23 October 1998 (23.10.98) DK

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(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
In English translation (filed in Danish).
Without international search report and to be republished upon receipt of that report.

(54) Title: A VIDEO OUTPUT AMPLIFIER

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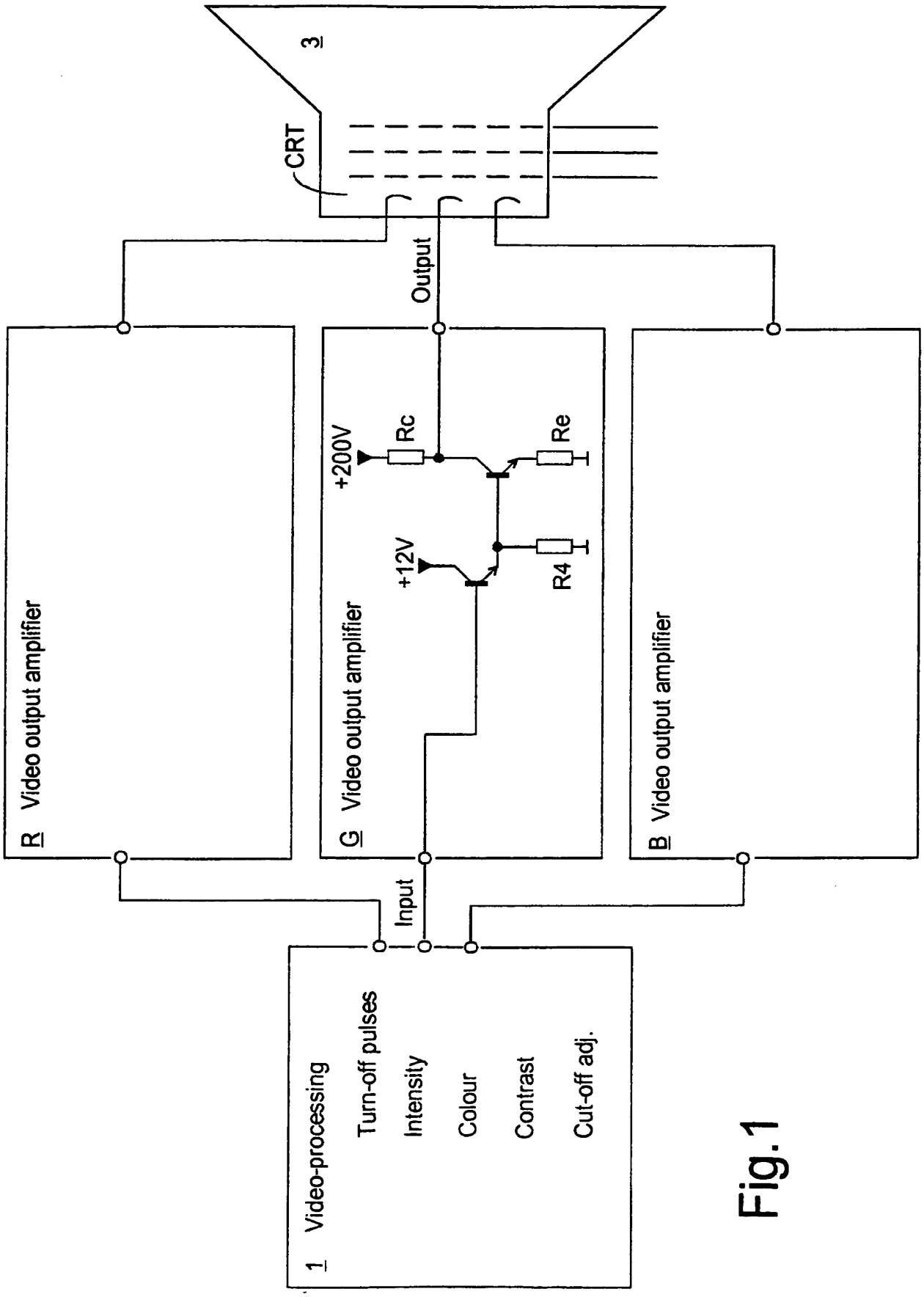
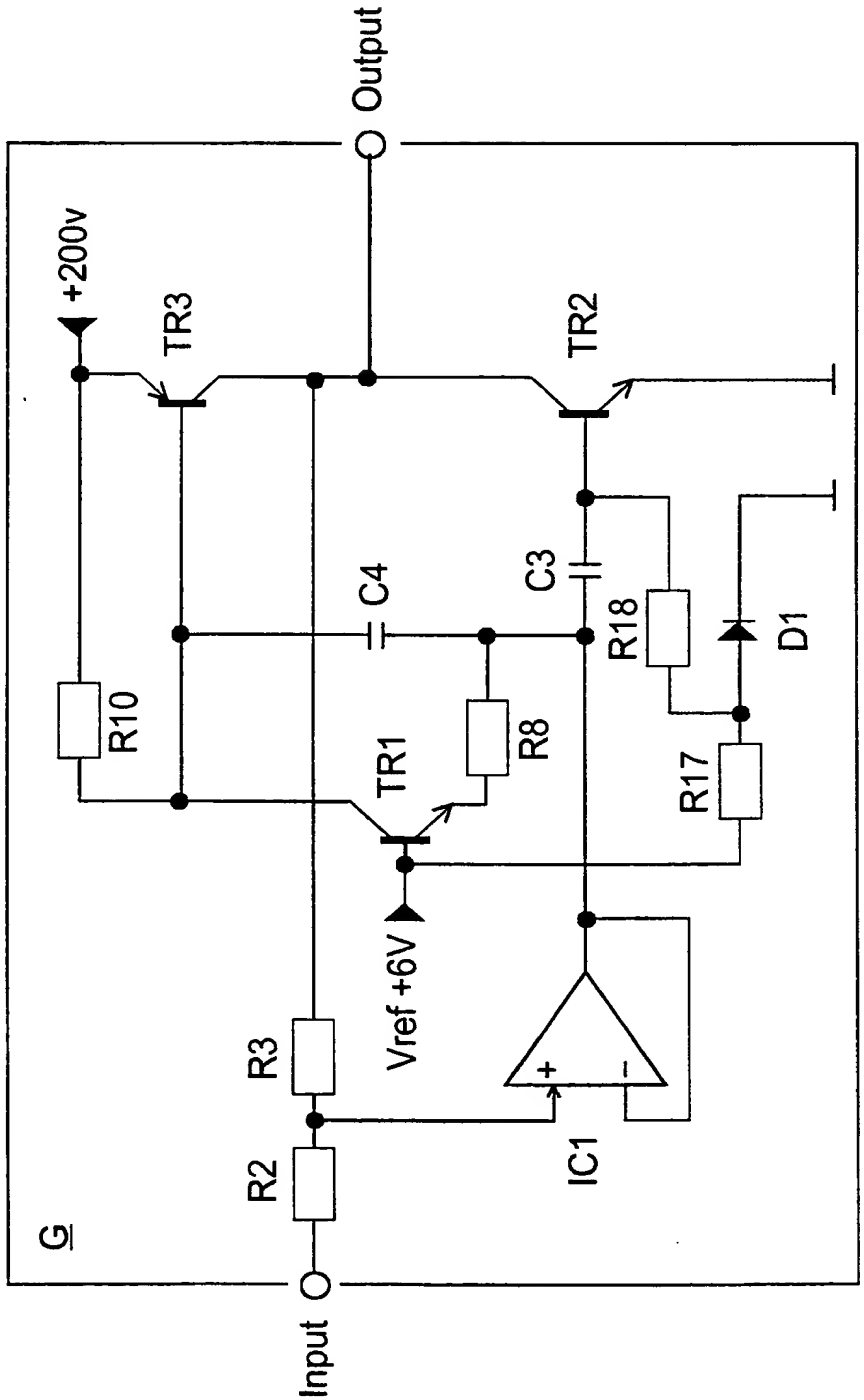

3
CRT
Output
+200V
Rc
Re
+12V
R4
R Video output amplifier
G Video output amplifier
B Video output amplifier
Input
1 Video-processing
Turn-off pulses
Intensity
Colour
Contrast
Cut-off adj.

Fig.1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+200v
TR3
TR2
C4
C3
R18
D1
R10
R8
TR1
R17
Vref +6V
R3
IC1
R2
Input

Fig.2

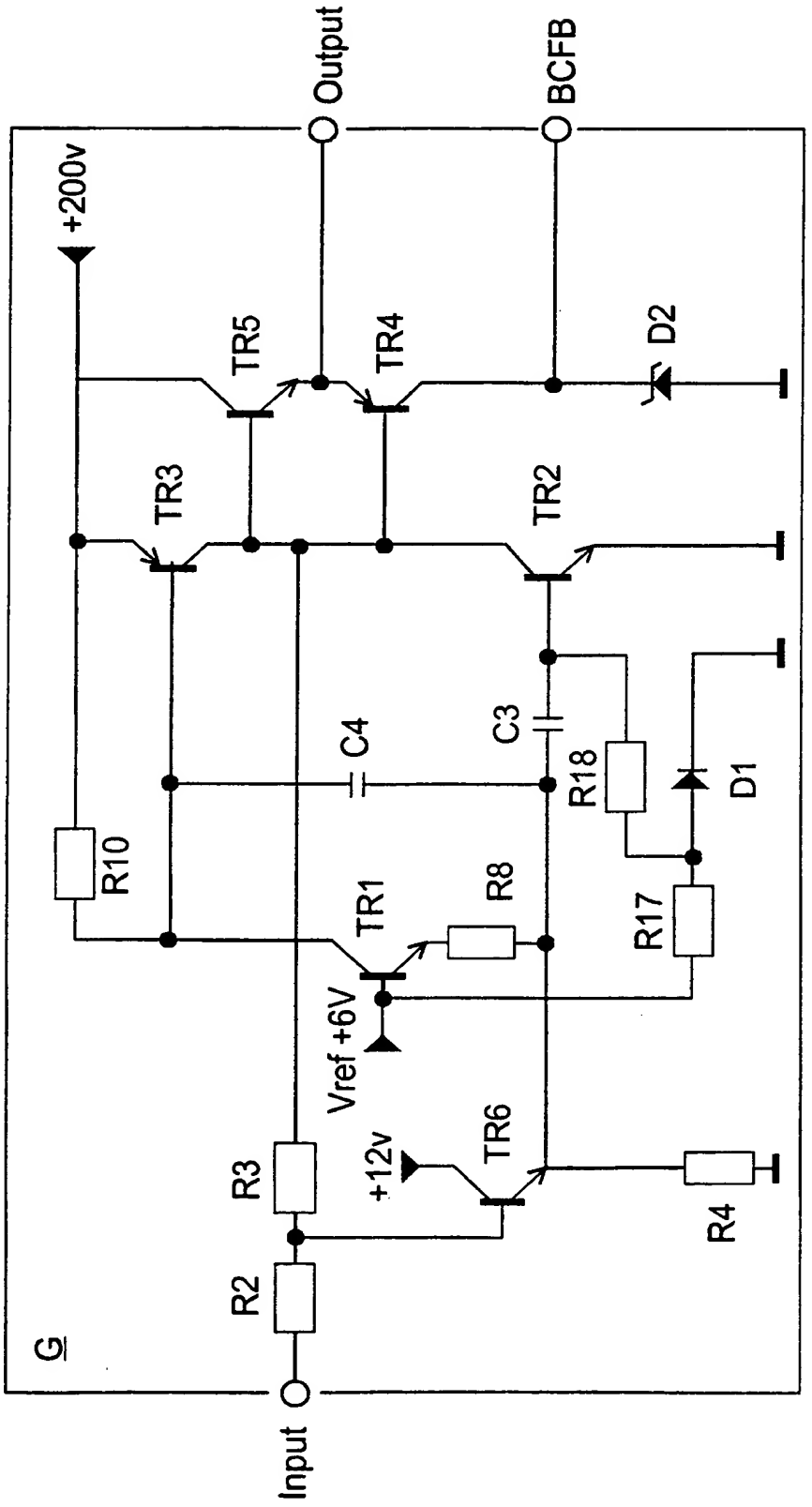
Output
BCFB
+200v
TR5
TR4
D2
TR3
TR2
C4
C3
R18
D1
R10
TR1
R8
R17
Vref +6V
TR6
+12v
R3
R4
R2
G
Input

Fig.3

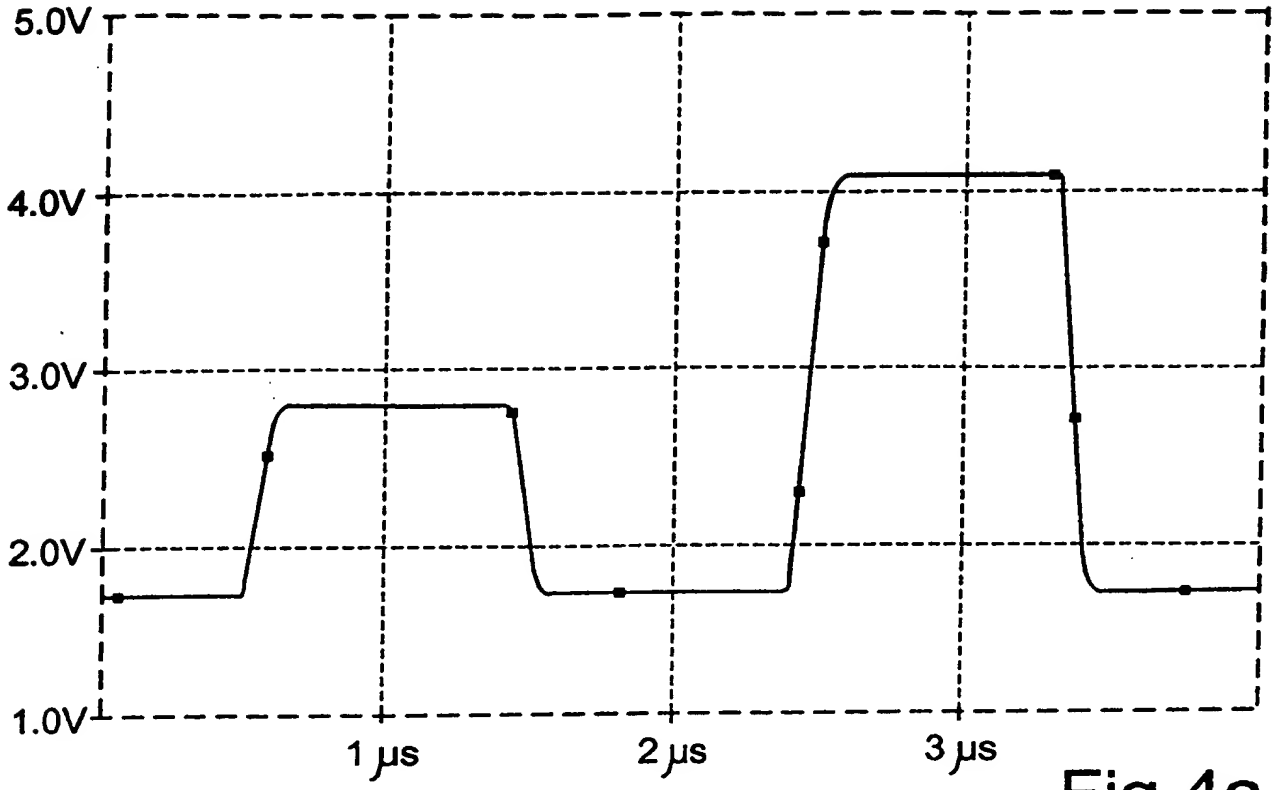

Fig.4a

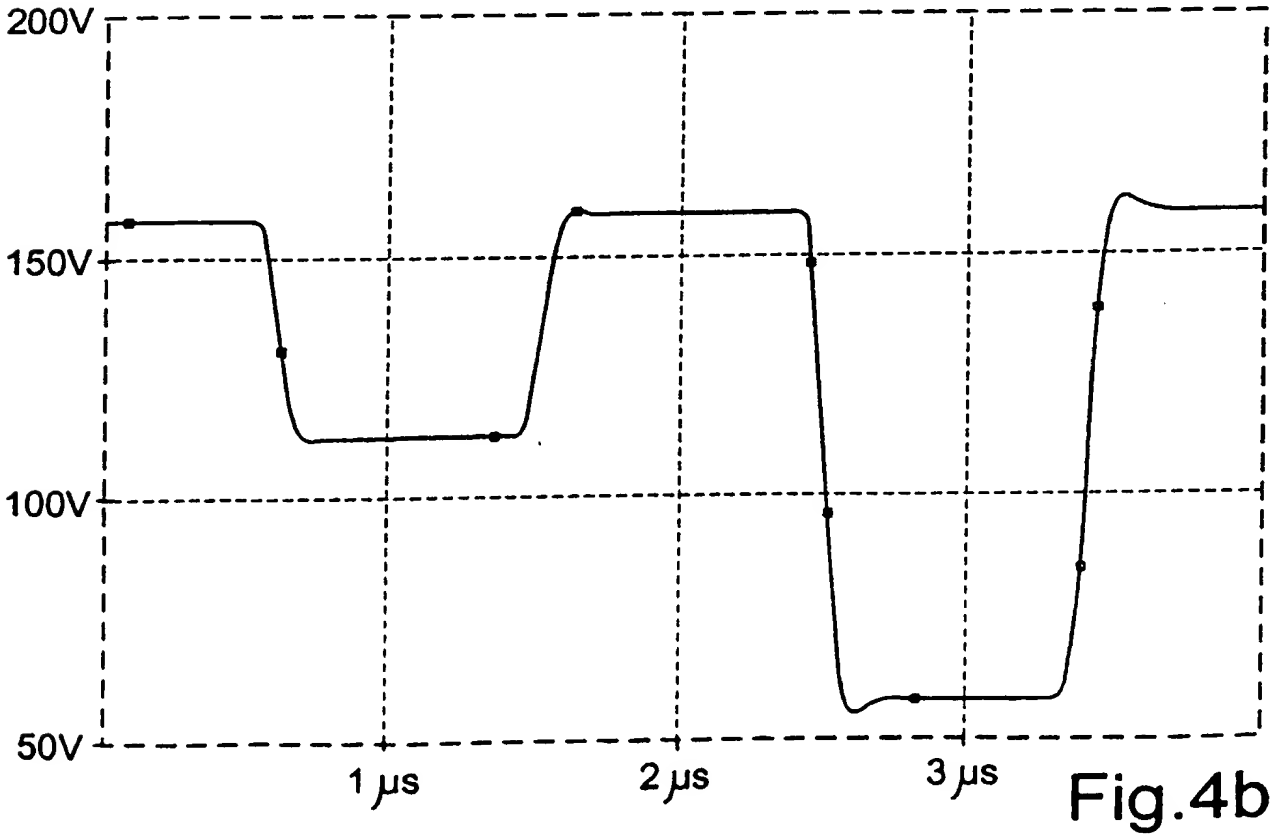

Fig.4b

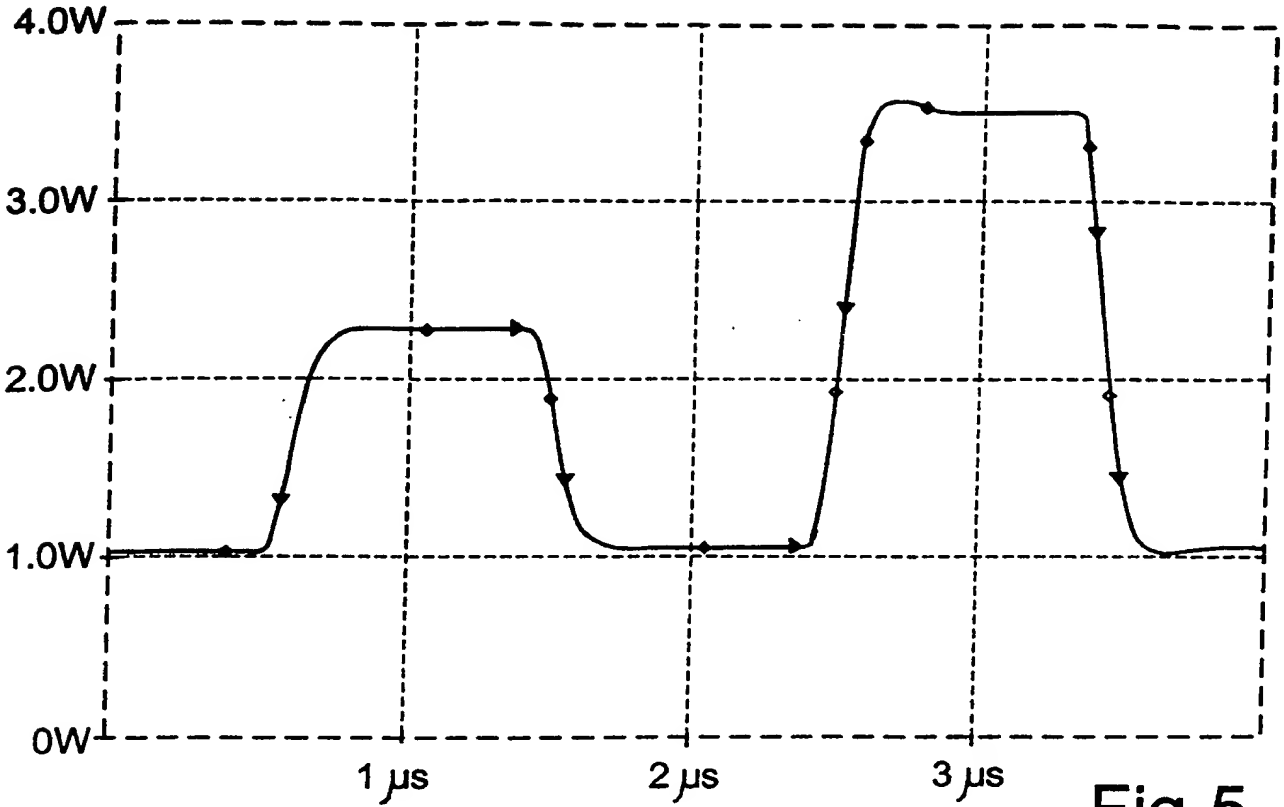

Fig.5

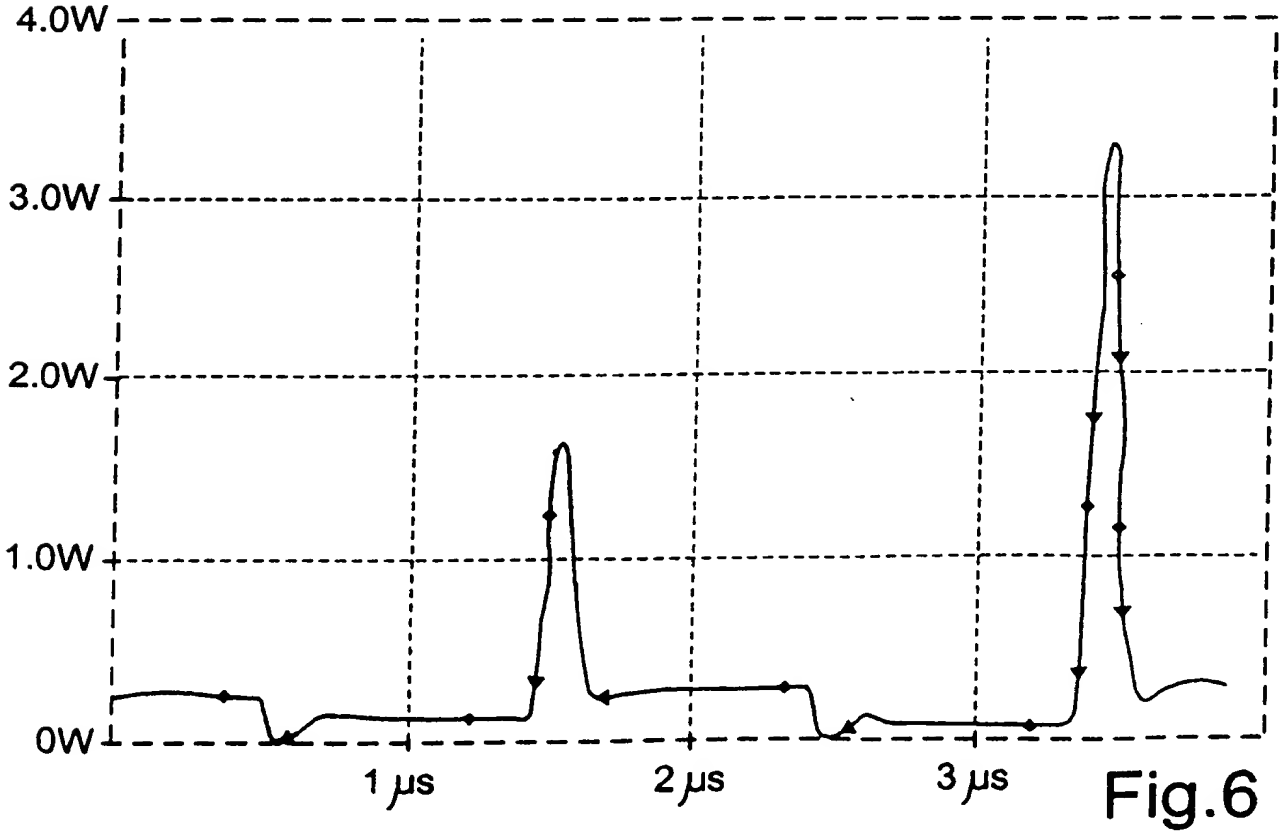

Fig.6

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

1) International Patent Classification 7 :
H03F 3/30, H04N 5/14, 9/64

A3

(11) International Publication Number: WO 00/25420

(43) International Publication Date: 4 May 2000 (04.05.00)

21) International Application Number: PCT/DK99/00579

22) International Filing Date: 22 October 1999 (22.10.99)

(30) Priority Data:
PA 1998 01371 23 October 1998 (23.10.98) DK

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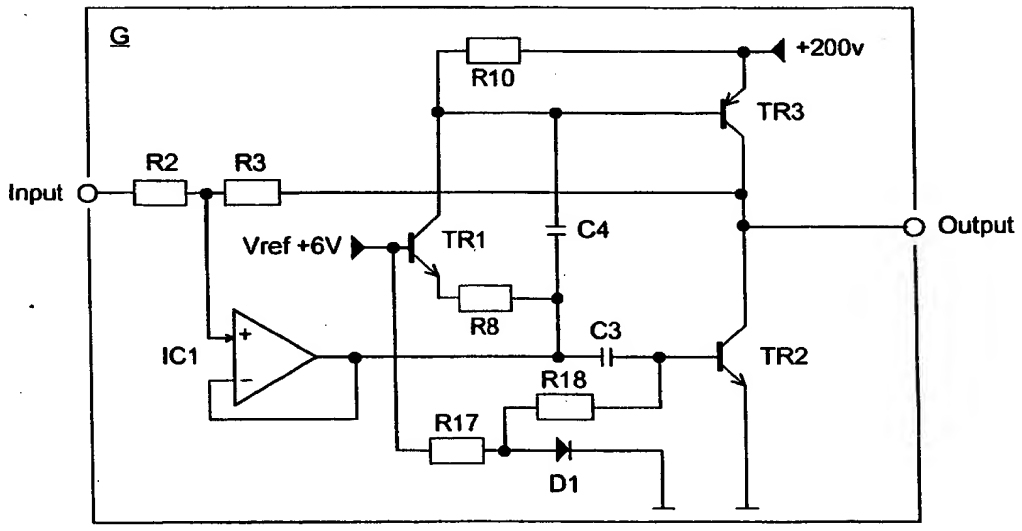
Published
With international search report.
In English translation (filed in Danish).

(88) Date of publication of the international search report:
27 July 2000 (27.07.00)

(54) Title: A VIDEO OUTPUT AMPLIFIER



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INTERNATIONAL SEARCH REPORT

Interm ⁻al Application No
PCT/DK 99/00579

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H03F3/30 H04N5/14 H04N9/64

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H03F H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"Schaltungen zur Ansteuerung der Farbbildröhre" FUNKSCHAU, PART I, no. 21, 1987, page 60 XP002900931 page 60	1,4,5
A	---	2,3
X	"Schaltungen zur Ansteuerung der Farbbildröhre" FUNKSCHAU, PART II, no. 22, 1987, pages 83-86, XP002900932 the whole document	1,4,5
A	---	2,3
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[X] Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search	Date of mailing of the international search report
20 March 2000	19.04.2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Bo GustaVSSON

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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